



## PATENT ABSTRACTS OF JAPAN

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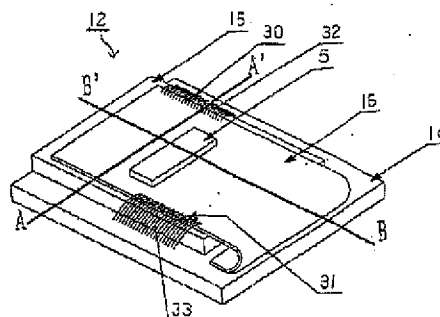
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DISPLAY EQUIPMENT****(57) Abstract:**

**PROBLEM TO BE SOLVED:** To provide a liquid crystal display device which heightens density of wiring and narrows a picture frame, further prevents the unevenness of display density from being generated, is provided with high quality and high reliability and is low-cost.

**SOLUTION:** The liquid crystal display device 12 comprises a large area glass substrate 14 on the signal line side and a small area glass substrate 15 on the scanning line side stuck to each other via a liquid crystal. One edge of one principal surface of an FPC (flexible printed circuit) 16 is stuck to a non-display region of the glass substrate 14 and a part of the FPC 16 adjacent to the stuck part is bent. The other edge of the

FPC 16 is drawn out outside the glass substrate 15 on the scanning line side and circuit components such as a driver IC 5 for driving the liquid crystal and a capacitor (not shown in the figure) are mounted on the FPC 16.

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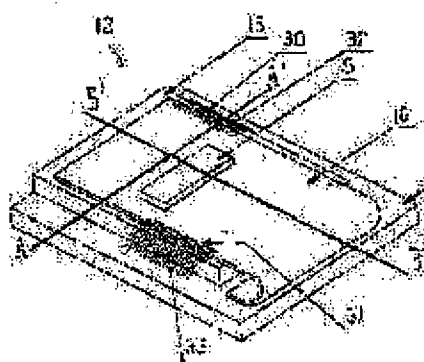
#### (54) LIQUID CRYSTAL DISPLAY DEVICE AND DISPLAY EQUIPMENT

##### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a liquid crystal display device which heightens density of wiring and narrows a picture frame, further prevents the unevenness of display density from being generated, is provided with high quality and high reliability and is low-cost.

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adjacent to the stuck part is bent. The other edge of the FPC 16 is drawn out outside the glass substrate 15 on the scanning line side and circuit components such as a driver IC 5 for driving the liquid crystal and a capacitor (not shown in the figure) are mounted on the FPC 16.




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#### CLAIMS

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##### [Claim(s)]

[Claim 1] It is the high-reflective-liquid-crystal display in a liquid crystal display which intervenes a liquid crystal between two transparent substrates which laminate a transparent electrode and an orientation layer one by one in which while formed a light reflection layer in an outside surface or an inner surface of a transparent substrate, By fixing one end of a flexible circuit board to a transparent substrate of another side,

and pulling out the other end on the outside of one transparent substrate. A flexible circuit board which mounted a driver IC for a liquid crystal drive is allocated in the outside of one transparent substrate, A liquid crystal display connecting between a terminal furthermore formed on a transparent substrate of another side, and terminals on a flexible circuit board by wire bonding, and carrying out a signal input from a driver IC for a liquid crystal drive.

[Claim 2] Display equipment carrying a liquid crystal display of claim 1.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the display equipment carrying the liquid crystal display and this liquid crystal display of the reflection type which makes unnecessary sources of a transmission type fill-in flash, such as a back light.

[0002]

[Description of the Prior Art] In recent years, although the liquid crystal display is used for displays, such as a cellular phone and a portable location system (referred to as a common name and GPS), the characteristic of the applicability in a miniaturization, low power consumption, and the outdoors is called for from this liquid crystal display.

[0003] In order to accept this demand, the high-reflective-liquid-crystal display and transfective LCD which are characterized by the good visibility in the outdoors have come to be used.

[0004] As for these liquid crystal displays, in uses, such as a cellular phone, conventionally, the panel of the monochrome display was used and the driver IC for a liquid crystal drive of one chip has been used.

[0005] The flexible circuit board which mounted the driver IC for a liquid crystal drive as a packaging system in these liquid crystal displays. COF mounting which used (a flexible circuit board is hereafter written as FPC), TAB mounting using the tape carrier package (a tape carrier package is hereafter written as TCP) which contained the driver IC for a liquid crystal drive, and the COG package which carries out direct mounting of the driver IC for a liquid crystal drive on a transparent substrate are advocated.

[0006] Drawing 6 - drawing 8 explain the outline of the passive-matrix type reflection

type monochrome liquid crystal display using these COF mounting, TAB mounting, and a COG package.

[0007]As for the top view of the liquid crystal display of COF mounting, and drawing 7, the top view of the liquid crystal display of TAB mounting and drawing 8 of drawing 6 are the top views of the liquid crystal display of a COG package.

[0008]When the liquid crystal display 1 of drawing 6 is explained first, the liquid crystal display panel 2 which is the main component part is the structure which pasted together the signal side glass substrate 3 of a large area, and the scan side glass substrate 4 of the small area via the liquid crystal, FPC6 which mounted the driver IC 5 for a liquid crystal drive in this signal side glass substrate 3 is stuck.

[0009]This FPC6 pastes together the base film which comprises polyimide and polyester, the circuit pattern formed in copper foil, and the cover lay which comprises polyimide and polyester one by one with polyester system adhesives.

[0010]Circuit components (not shown), such as a capacitor, can also be mounted in FPC6 in addition to driver IC 5 for a liquid crystal drive.

[0011]7 is signal wiring which comprises ITO formed in the non display regions on the signal side glass substrate 3 in order to make the display portion of the liquid crystal display panel 2, and FPC6 energize.

[0012]The liquid crystal display 8 of TAB mounting of drawing 7 is replaced with FPC6 used for the aforementioned liquid crystal display 1, and TOP9 which mounted the driver IC 5 for a liquid crystal drive is used.

[0013]Although the driver IC 5 for a liquid crystal drive is mounted in the non display regions on the signal side glass substrate 3 in the liquid crystal display 10 of the COG package of drawing 8, FPC11 which mounted circuit components (not shown), such as a capacitor, to these non display regions was stuck, and this has inputted the signal into the driver IC 5 for a liquid crystal drive.

[0014]

[Problem(s) to be Solved by the Invention]As mentioned above, the liquid crystal display of uses, such as a cellular phone, is the monochrome type which used COF mounting, TAB mounting, and a COG package.

[0015]On the other hand, a color type liquid crystal display is called for and the shift to an electrochromatic display display panel from a monochrome liquid crystal display panel is progressing to the reflection type and transfective liquid crystal display especially in the cellular-phone use in recent years.

[0016]Therefore, the amount of information dealt with as display equipment, such as a personal digital assistant, with such colorization carries out an increase, therefore it is

anxious for the liquid crystal display panel of the big screen with more dot numbers.

[0017]However, in the liquid crystal displays 1, 8, and 10 of each packaging system of drawing 6 - drawing 8 which was mentioned above, Are the structure which installed the driver IC 5 for a liquid crystal drive, and the display portion side by side, therefore the wire length of the signal wiring 7 stops gathering. The voltage waveform impressed to the electrode in a display portion became blunt, the difference arose in the effective voltage concerning a liquid crystal by this, and, as a result, density unevenness had occurred because the difference becomes remarkable, originate in a wiring resistance difference by this, and display quality falls, for example, wiring resistance differs between each pixel. This density unevenness was a very remarkable technical problem in the color liquid crystal display.

[0018]Although the pattern width of the signal wiring 7 is adjusted and it is [ that this technical problem should be canceled ] possible to improve a resistance gap, there is a limit also in that art. Therefore, the metallic wiring using aluminum etc. is also examined instead of the signal wiring by ITO. However, since mass production nature will fall due to the fall of a manufacturing yield if it is necessary to establish the art for it and to perform equipment introduction etc. and and a metal wiring pattern is made overcrowded, it is necessary to extend non display regions but, and, On the other hand, the liquid crystal display panel of a narrow picture frame is no longer obtained, and it becomes unsuitable at the use of a personal digital assistant.

[0019]In personal digital assistants, such as a cellular phone, although a miniaturization, slimming down, and a weight saving are also needs of a commercial scene increasingly, it can be said that it has not resulted even to such an extent that it may still be satisfied.

[0020]Therefore, while the purpose of this invention improves a manufacturing yield and mass production nature, Wiring-density-izing and narrow picture frame-ization of a liquid crystal display panel are attained, as a difference does not arise in the effective voltage further built over a liquid crystal, generating of density unevenness is prevented, and it is in providing the liquid crystal display of high quality, high-reliability, and low cost by this.

[0021]Other purposes of this invention are to provide the liquid crystal display which accomplished a miniaturization and slimming down.

[0022]The purpose of further others of this invention is to provide a liquid crystal display suitable for a colored presentation.

[0023]The purpose of this invention carries the liquid crystal display of this this invention, and there is in the personal digital assistant which attained high quality and

high-reliability, low cost, a miniaturization, and slimming down, and providing display equipment further.

[0024]

[Means for Solving the Problem]A liquid crystal display of this invention is a high-reflective-liquid-crystal display in a liquid crystal display which intervenes a liquid crystal between two transparent substrates which laminate a transparent electrode and an orientation layer one by one in which while formed a light reflection layer in an outside surface or an inner surface of a transparent substrate. By fixing one end of a flexible circuit board to a transparent substrate of another side, and pulling out the other end on the outside of one transparent substrate. A flexible circuit board which mounted a driver IC for a liquid crystal drive is allocated in the outside of one transparent substrate. Between a terminal furthermore formed on a transparent substrate of another side and terminals on a flexible circuit board is connected by wire bonding, and a signal input is carried out from a driver IC for a liquid crystal drive.

[0025]Display equipment of this invention carried a liquid crystal display of this invention.

[Function]The liquid crystal display of this invention allocates in the outside of one transparent substrate by the side of a display rear face the flexible circuit board which mounted the driver IC for a liquid crystal drive like the above-mentioned composition. By connecting between the terminal furthermore formed on the transparent substrate of another side, and the terminals on a flexible circuit board by wire bonding, and carrying out a signal input from the driver IC for a liquid crystal drive. The circuit pattern which was being taken about like the conventional liquid crystal display in non display regions becomes very small, or becomes unnecessary.

[0026]Therefore, in the liquid crystal display of the conventional packaging system, although the width of non display regions was necessity about 4-5 mm in the liquid crystal panel of a 1.5-inch class. In the liquid crystal display of this invention to this, the width can make it small to about 1 mm, and, thereby, enlargement of the liquid crystal display panel by expansion of overcrowded-izing of a circuit pattern and non display regions is canceled.

[0027]By and the thing accomplished so that between the terminal formed on the transparent substrate of another side and the terminals on a flexible circuit board might be connected by wire bonding like the above-mentioned composition and a signal input might be carried out from the driver IC for a liquid crystal drive by this. By namely, the thing carried out to the structure which piled up the driver IC for a liquid crystal drive on the display portion. Density unevenness stops occurring by canceling

the provincial accent of the voltage waveform which the wiring resistance difference resulting from the wire length of a circuit pattern is lost, and is impressed to an electrode in a display portion, As a result, display quality is improved and it is notably improved in the color liquid crystal display which allocated 1 \*\*\*\*\* of the driver ICs for a liquid crystal drive especially.

[0028]Although the applicant for this patent already proposed the liquid crystal display which allocated the driver IC for a liquid crystal drive, and the circuit board of long shape in the rear face of a liquid crystal display panel, he can say that the still following technical problems occur.

[0029]By the circuit board, it is the multilayer interconnection structure which formed 1 layer wiring and the wiring layer more than two-layer in the inside of a glass epoxy board, therefore substrate thickness becomes large extremely, and it cannot yet be satisfied with the market needs of slimming down in recent years. As for the wire length, although between the terminal of the circuit board of substrate thickness and the terminals on a transparent substrate is connected by wire bonding, it is insufficient to become large in the accuracy side of bonding. And the mount part of the driver IC for a liquid crystal drive is also limited to non display regions by arranging the circuit board of long shape.

[0030]

[Embodiment of the Invention]A passive-matrix type (STN) colored presentation is made into an example, and drawing 1 - drawing 5 explain the outline of the high-reflective-liquid-crystal display of this invention.

[0031]drawing 1 is a perspective view of the reflection type liquid crystal display 12 -- drawing 2 -- drawing 1 -- cutting plane line A-A -- ' -- the sectional view and drawing 3 to depend -- drawing 1 -- cutting plane line B-B -- ' -- it is a sectional view to twist. The top view and drawing 5 in which the composition of the transparent electrode by the side of the scan of the liquid crystal display panel 13 in which drawing 4 constitutes the main important point of the liquid crystal display 12 is shown are an important section enlarged drawing of the liquid crystal display panel 13.

[0032]As shown in drawing 1 - drawing 3, the liquid crystal display 12 is the structure which pasted together the signal side glass substrate 14 of the rectangular shape of the large area which is a transparent substrate of said another side, and the scan side glass substrate 15 of the rectangular shape of the small area which is said one transparent substrate via the liquid crystal.

[0033]the portion top which does not counter with the scan side glass substrate 15 in near the one-side end which is non display regions of the signal side glass substrate

14 — FPC16 of rectangular form — the one-side end of the principal surface on the other hand, [ stick and ] It bends that it is also near [ that ] pasting about this FPC16, and other \*\*\*\* of FPC16 are pulled out on the outside of the scan side glass substrate 15, thereby, adhesives (not shown), such as a double-sided tape, are used for the outside of the scan side glass substrate 15, and FPC16 is allocated.

[0034]This FPC16 pastes together the base film which comprises polyimide and polyester, the circuit pattern formed in copper foil, and the cover lay which comprises polyimide and polyester one by one with polyester system adhesives.

[0035]And on FPC16, circuit components (not shown), such as the driver IC 5 for a liquid crystal drive and a capacitor, are mounted.

[0036]In the liquid crystal display 12 of this invention, in order to use the still higher-density pixel pattern on a high screen, carry out the display screen of the liquid crystal display panel 13 for 2 minutes, but. As shown in drawing 4 in connection with this, the transparent electrode by the side of the scan arranged on the scan side glass substrate 15 is divided into the transparent electrode pattern 17 and the transparent electrode pattern 18.

[0037]The composition of the liquid crystal display panel 13 is as follows further about these transparent electrode patterns 17 and 18.

[0038]As shown in drawing 5, the light reflection layer 19 formed on the medial surface of the scan side glass substrate 15 with the metal thin film which comprises aluminum is formed, The light filter 20 arranged for every pixel on this light reflection layer 19, the overcoat layer 21 which comprises acrylic resin, the transparent electrode 22 which comprises ITO, and the orienting film 23 which changes from the polyimide resin which carried out rubbing to a certain direction are laminated one by one.

[0039]On the signal side glass substrate 14, the transparent electrode 24 which comprises ITO, the insulating layer 25 which comprises  $\text{SiO}_2$ , and the orienting film 26 which changes from the polyimide resin which carried out rubbing to a certain direction are laminated one by one. And although the signal side glass substrate 14 and the scan side glass substrate 15 are pasted together via the liquid crystal 27 as a sealant is also, and the liquid crystal 27 is enclosed, In that case, both transparent electrodes 22 and 24 are made to intersect perpendicularly, and it accomplishes with each pixel that it is also at the crossing portion, and constitutes in the reflective color LCD panel 12 of a passive matrix.

[0040]The phase difference plate (not shown) which comprises polycarbonate etc., and the polarizing plate (not shown) of an iodine system are stuck on the display



surface side of this liquid crystal display 12 using the adhesive material which comprises an acrylic material one by one.

[0041]According to the liquid crystal display 12 of the above-mentioned composition, the transparent electrode 22 formed in the scan side glass substrate 15 is equivalent to the aforementioned transparent electrode patterns 17 and 18. The transparent electrode 22 (transparent electrode patterns 17 and 18), By allotting conductive members, such as Ag material, between the substrate 14 and the substrate 15, or using the sealant containing electric conduction particles. Make the wiring which comprises ITO formed on the signal side glass substrate 14 energize, this wiring is made to extend even in the non display regions on the signal side glass substrate 14, a chromium layer and an aluminum layer are laminated one by one at that end, and the terminals 28 and 29 are formed.

[0042]It corresponded to the transparent electrode pattern 17, the terminal 29 corresponded to the transparent electrode pattern 18, and the terminal 28 arranges both terminals 28 and 29 to the part which does not face each other on the both sides of the opposing side of a display screen, respectively.

[0043]By what the terminals 30 and 31 which comprise an Au layer were formed also on FPC16, between the terminal 28 and the terminals 30 was connected by the wire bonding 32, and between the terminal 29 and the terminals 31 was connected for by the wire bonding 33. A signal input can be carried out to the display portion of the liquid crystal display panel 13 through the wire bonding 32 and 33 from the driver IC 5 for a liquid crystal drive.

[0044]The transparent electrode 24 on the signal side glass substrate 14 lets a sealant pass, and extends even to the part with tension of FPC16, and energization connection is made with the terminal of this FPC16.

[0045]According to the liquid crystal display 12 of this invention, the terminals 30 and 31 on FPC16, and the terminals 28 and 29 on the non display regions of the signal side glass substrate 14 in this way because it took [ the wire bonding 32 and ] 33. The width of the non display regions became small, and became unnecessary [ the circuit pattern which was being taken about in non display regions like the conventional liquid crystal displays 1, 8, and 10 shown in drawing 6 - drawing 8 ].

[0046]For example, when the liquid crystal display 1 of COF mounting shown in the liquid crystal display 12 and drawing 6 of this invention is contrasted, it comes to be shown in drawing 9. Both sides are the liquid crystal panels of a 1.5-inch class.

[0047]The figure (b) is a sectional view according to cutting plane line A-A' at drawing 1 as well as drawing 2, and drawing 9 (\*\*) is a sectional view of the liquid crystal

display 1 in the same standard.

[0048]As shown in drawing 9 (b), width A of the non display regions in the liquid crystal display 12 of this invention was able to be made small to about 1 mm, but the width B of the non display regions in the liquid crystal display 1 of drawing 9 (\*\*) to this was necessity about 5 mm.

[0049]Thus, in the conventional liquid crystal displays 1, 8, and 10, had to expand non display regions, and had to enlarge the width as the number of scan lines followed on carrying out an increase and the liquid crystal display panel big-screen-ized, but. Although based also on the size of the liquid crystal display panel 13 in the liquid crystal display 12 of this invention to this, As for the width A of non display regions, 3 mm or less and enlargement of the liquid crystal display panel 13 can make it suitably small to 1 mm or less the optimal 2 mm or less, and according to expansion of overcrowded-izing of a circuit pattern and non display regions by this were canceled.

[0050]In this invention, the wiring resistance difference resulting from the wire length of a circuit pattern like before was canceled, the density unevenness by the provincial accent of the voltage waveform impressed to an electrode in a display portion in connection with this stops having occurred, and display quality has been improved by this.

[0051]Moreover, by the thing of the display portion of the liquid crystal display panel 13 for which FPC16 is mostly allotted in the center, it became the same among both sides about the interval in which it results to each terminals 30 and 31 formed on this, and this was also able to raise display quality.

[0052]Next, it is explained that a personal digital assistant is also about the display of this invention. The cellular phone 34 which carries the liquid crystal display 12 in drawing 10 is explained. According to the cellular phone 34, the liquid crystal display 12 is allocated in the small case 35. The antenna 36 for transmission/reception is formed in the upper part of the case 35, and the receiver 37 and the microphone 38 are further formed in the surface.

[0053]The personal digital assistant 39 which allocated the liquid crystal display 12 in drawing 11 is explained. This personal digital assistant 39 is shown as various information terminals other than cellular-phone 34. For example, although there are a clock, a computer, a game machine machine, pedmeter, GPS, POS, a handy terminal, an industrial instrument, etc., it is not limited to these. Also in this personal digital assistant 39, the liquid crystal display 12 is allocated in the small case 40.

[0054]In this way, in these cellular phones 34 or the personal digital assistant 39, it is having used the miniaturized liquid crystal display liquid crystal display 12, and the

miniaturization was able to be attained further.

[0055]Although it illustrated that the cellular phone 34 and the personal digital assistant 39 were also as a device which allocated the liquid crystal display 12 of this invention, this liquid crystal display 12 is applicable also to the various equipment used as a display device. For example, it may be used also for the plotting board of various display equipment, such as a display panel in a sewing machine, a stereo, a musical instrument, video, ATM, a copying machine and a facsimile, a station, a restaurant, and a factory.

[0056]This invention is not limited to the above-mentioned example of an embodiment, and various change, improvement, etc. in the range which do not deviate from the gist of this invention do not interfere at all.

[0057]For example, although formed as the light reflection layer 19 in the above-mentioned example with the metal thin film which comprises aluminum, in order to replace with this and to raise reflectance, the multilayer film which comprises a dielectric may be used.

[0058]Although this example explained that the high-reflective-liquid-crystal display for passive-matrix type (STN) colored presentations was also, Replace with this and A TN liquid crystal method, a TFT-liquid-crystal method, a ferroelectric liquid crystal method, the various high-reflective-liquid-crystal displays using an antiferroelectricity liquid crystal method, a bistability type liquid crystal method, etc. being sufficient, and the light reflection layer 19 being further, formed as the semi transmitting layer which sets and has the both sides of light reflex nature and a light transmittance state is also, and, Even if it uses a transfective liquid crystal display by having a back light, the effect of this invention is similarly done so.

[0059]

[Effect of the Invention]According to [ above passage ] the liquid crystal display of this invention, the flexible circuit board which mounted the driver IC for a liquid crystal drive is allocated in the outside of one transparent substrate by the side of a display rear face, By having connected between the terminal furthermore formed on the transparent substrate of another side, and the terminals on a flexible circuit board by wire bonding, and having carried out the signal input from the driver IC for a liquid crystal drive. The metal wiring pattern which was being taken about like the conventional liquid crystal display in non display regions becomes very small, or, Or became unnecessary, as a result, enlargement of the liquid crystal display panel by expansion of overcrowded-izing of a metal wiring pattern and non display regions was canceled, the density unevenness by the provincial accent of the voltage waveform

impressed to the electrode in a display portion stops having occurred moreover, and display quality has been improved.

[0060]In this invention, it used that wiring-density-izing and narrow picture frame-ization of the liquid crystal display panel have been attained easily compared with the former.

By that cause, a manufacturing yield and mass production nature could be improved, the manufacturing cost decreased by this, and, as a result, the low cost liquid crystal display has been provided.

[0061]And in this invention, it is having used FPC and the liquid crystal display which accomplished the both sides of a miniaturization and slimming down has been provided. And the liquid crystal display of this invention is suitable for a colored presentation.

[0062]In the display of this invention, it is having carried the liquid crystal display of this this invention, and could change further again with the personal digital assistant which attained high quality and high-reliability, low cost, a miniaturization, and slimming down, and also display equipment.

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## TECHNICAL FIELD

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[Field of the Invention]This invention relates to the display equipment carrying the liquid crystal display and this liquid crystal display of the reflection type which makes unnecessary sources of a transmission type fill-in flash, such as a back light.

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## PRIOR ART

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[Description of the Prior Art]In recent years, although the liquid crystal display is used for displays, such as a cellular phone and a portable location system (referred to as a common name and GPS), the characteristic of the applicability in a miniaturization, low power consumption, and the outdoors is called for from this liquid crystal display.

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come to be used.

[0004]As for these liquid crystal displays, in uses, such as a cellular phone, conventionally, the panel of the monochrome display was used and the driver IC for a liquid crystal drive of one chip has been used.

[0005]The flexible circuit board which mounted the driver IC for a liquid crystal drive as a packaging system in these liquid crystal displays. COF mounting which used (a flexible circuit board is hereafter written as FPC), TAB mounting using the tape carrier package (a tape carrier package is hereafter written as TCP) which contained the driver IC for a liquid crystal drive, and the COG package which carries out direct mounting of the driver IC for a liquid crystal drive on a transparent substrate are advocated.

[0006]Drawing 6 - drawing 8 explain the outline of the passive-matrix type reflection type monochrome liquid crystal display using these COF mounting, TAB mounting, and a COG package.

[0007]As for the top view of the liquid crystal display of COF mounting, and drawing 7, the top view of the liquid crystal display of TAB mounting and drawing 8 of drawing 6 are the top views of the liquid crystal display of a COG package.

[0008]When the liquid crystal display 1 of drawing 6 is explained first, the liquid crystal display panel 2 which is the main component part is the structure which pasted together the signal side glass substrate 3 of a large area, and the scan side glass substrate 4 of the small area via the liquid crystal, FPC6 which mounted the driver IC 5 for a liquid crystal drive in this signal side glass substrate 3 is stuck.

[0009]This FPC6 pastes together the base film which comprises polyimide and polyester, the circuit pattern formed in copper foil, and the cover lay which comprises polyimide and polyester one by one with polyester system adhesives.

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[0012]The liquid crystal display 8 of TAB mounting of drawing 7 is replaced with FPC6 used for the aforementioned liquid crystal display 1, and TCP9 which mounted the driver IC 5 for a liquid crystal drive is used.

[0013]Although the driver IC 5 for a liquid crystal drive is mounted in the non display regions on the signal side glass substrate 3 in the liquid crystal display 10 of the COG package of drawing 8, FPC11 which mounted circuit components (not shown), such as

a capacitor, to these non display regions was stuck, and this has inputted the signal into the driver IC 5 for a liquid crystal drive.

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## EFFECT OF THE INVENTION

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[Effect of the Invention]According to [ above passage ] the liquid crystal display of this invention, the flexible circuit board which mounted the driver IC for a liquid crystal drive is allocated in the outside of one transparent substrate by the side of a display rear face, By having connected between the terminal furthermore formed on the transparent substrate of another side, and the terminals on a flexible circuit board by wire bonding, and having carried out the signal input from the driver IC for a liquid crystal drive. The metal wiring pattern which was being taken about like the conventional liquid crystal display in non display regions becomes very small, or, Or became unnecessary, as a result, enlargement of the liquid crystal display panel by expansion of overcrowded-izing of a metal wiring pattern and non display regions was canceled, the density unevenness by the provincial accent of the voltage waveform impressed to the electrode in a display portion stops having occurred moreover, and display quality has been improved.

[0060]In this invention, it used that wiring-density-izing and narrow picture frame-ization of the liquid crystal display panel have been attained easily compared with the former.

By that cause, a manufacturing yield and mass production nature could be improved, the manufacturing cost decreased by this, and, as a result, the low cost liquid crystal display has been provided.

[0061]And in this invention, it is having used FPC and the liquid crystal display which accomplished the both sides of a miniaturization and slimming down has been provided. And the liquid crystal display of this invention is suitable for a colored presentation.

[0062]In the display of this invention, it is having carried the liquid crystal display of this this invention, and could change further again with the personal digital assistant which attained high quality and high-reliability, low cost, a miniaturization, and slimming down, and also display equipment.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]As mentioned above, the liquid crystal display of uses, such as a cellular phone, is the monochrome type which used COF mounting, TAB mounting, and a COG package.

[0015]On the other hand, a color type liquid crystal display is called for and the shift to an electrochromatic display display panel from a monochrome liquid crystal display panel is progressing to the reflection type and transfective liquid crystal display especially in the cellular-phone use in recent years.

[0016]Therefore, the amount of information dealt with as display equipment, such as a personal digital assistant, with such colorization carries out an increase, therefore it is anxious for the liquid crystal display panel of the big screen with more dot numbers.

[0017]However, in the liquid crystal displays 1, 8, and 10 of each packaging system of drawing 6 - drawing 8 which was mentioned above, Are the structure which installed the driver IC 5 for a liquid crystal drive, and the display portion side by side, therefore the wire length of the signal wiring 7 stops gathering. The voltage waveform impressed to the electrode in a display portion became blunt, the difference arose in the effective voltage concerning a liquid crystal by this, and, as a result, density unevenness had occurred because the difference becomes remarkable, originate in a wiring resistance difference by this, and display quality falls, for example, wiring resistance differs between each pixel. This density unevenness was a very remarkable technical problem in the color liquid crystal display.

[0018]Although the pattern width of the signal wiring 7 is adjusted and it is [ that this technical problem should be canceled ] possible to improve a resistance gap, there is a limit also in that art. Therefore, the metallic wiring using aluminum etc. is also examined instead of the signal wiring by ITO. However, since mass production nature will fall due to the fall of a manufacturing yield if it is necessary to establish the art for it and to perform equipment introduction etc. and and a metal wiring pattern is made overcrowded, it is necessary to extend non display regions but, and, On the other hand, the liquid crystal display panel of a narrow picture frame is no longer obtained, and it becomes unsuitable at the use of a personal digital assistant.

[0019]In personal digital assistants, such as a cellular phone, although a miniaturization, slimming down, and a weight saving are also needs of a commercial scene increasingly, it can be said that it has not resulted even to such an extent that it may still be satisfied.

[0020]Therefore, while the purpose of this invention improves a manufacturing yield and mass production nature, Wiring-density-izing and narrow picture frame-ization of a liquid crystal display panel are attained, as a difference does not arise in the effective voltage further built over a liquid crystal, generating of density unevenness is prevented, and it is in providing the liquid crystal display of high quality, high-reliability, and low cost by this.

[0021]Other purposes of this invention are to provide the liquid crystal display which accomplished a miniaturization and slimming down.

[0022]The purpose of further others of this invention is to provide a liquid crystal display suitable for a colored presentation.

[0023]The purpose of this invention carries the liquid crystal display of this this invention, and there is in the personal digital assistant which attained high quality and high-reliability, low cost, a miniaturization, and slimming down, and providing display equipment further.

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## MEANS

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[Means for Solving the Problem]A liquid crystal display of this invention is a high-reflective-liquid-crystal display in a liquid crystal display which intervenes a liquid crystal between two transparent substrates which laminate a transparent electrode and an orientation layer one by one in which while formed a light reflection layer in an outside surface or an inner surface of a transparent substrate, By fixing one end of a flexible circuit board to a transparent substrate of another side, and pulling out the other end on the outside of one transparent substrate. A flexible circuit board which mounted a driver IC for a liquid crystal drive is allocated in the outside of one transparent substrate, Between a terminal furthermore formed on a transparent substrate of another side and terminals on a flexible circuit board is connected by wire bonding, and a signal input is carried out from a driver IC for a liquid crystal drive.

[0025]Display equipment of this invention carried a liquid crystal display of this invention.

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## OPERATION

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[Function]The liquid crystal display of this invention allocates in the outside of one transparent substrate by the side of a display rear face the flexible circuit board which mounted the driver IC for a liquid crystal drive like the above-mentioned composition, By connecting between the terminal furthermore formed on the transparent substrate of another side, and the terminals on a flexible circuit board by wire bonding, and carrying out a signal input from the driver IC for a liquid crystal drive. The circuit pattern which was being taken about like the conventional liquid crystal display in non display regions becomes very small, or becomes unnecessary.

[0026]Therefore, in the liquid crystal display of the conventional packaging system, although the width of non display regions was necessity about 4-5 mm in the liquid crystal panel of a 1.5-inch class, In the liquid crystal display of this invention to this, the width can make it small to about 1 mm, and, thereby, enlargement of the liquid crystal display panel by expansion of overcrowded-izing of a circuit pattern and non display regions is canceled.

[0027]By and the thing accomplished so that between the terminal formed on the transparent substrate of another side and the terminals on a flexible circuit board might be connected by wire bonding like the above-mentioned composition and a signal input might be carried out from the driver IC for a liquid crystal drive by this. By namely, the thing carried out to the structure which piled up the driver IC for a liquid crystal drive on the display portion. Density unevenness stops occurring by canceling the provincial accent of the voltage waveform which the wiring resistance difference resulting from the wire length of a circuit pattern is lost, and is impressed to an electrode in a display portion, As a result, display quality is improved and it is notably improved in the color liquid crystal display which allocated 1 \*\*\*\*\* of the driver ICs for a liquid crystal drive especially.

[0028]Although the applicant for this patent already proposed the liquid crystal display which allocated the driver IC for a liquid crystal drive, and the circuit board of long shape in the rear face of a liquid crystal display panel, he can say that the still following technical problems occur.

[0029]By the circuit board, it is the multilayer interconnection structure which formed 1 layer wiring and the wiring layer more than two-layer in the inside of a glass epoxy board, therefore substrate thickness becomes large extremely, and it cannot yet be satisfied with the market needs of slimming down in recent years. As for the wire length, although between the terminal of the circuit board of substrate thickness and

the terminals on a transparent substrate is connected by wire bonding, it is insufficient to become large in the accuracy side of bonding. And the mount part of the driver IC for a liquid crystal drive is also limited to non display regions by arranging the circuit board of long shape.

[0030]

[Embodiment of the Invention] A passive-matrix type (STN) colored presentation is made into an example, and drawing 1 - drawing 5 explain the outline of the high-reflective-liquid-crystal display of this invention.

[0031] drawing 1 is a perspective view of the reflection type liquid crystal display 12 -- drawing 2 -- drawing 1 -- cutting plane line A-A -- ' -- the sectional view and drawing 3 to depend -- drawing 1 -- cutting plane line B-B -- ' -- it is a sectional view to twist. The top view and drawing 5 in which the composition of the transparent electrode by the side of the scan of the liquid crystal display panel 13 in which drawing 4 constitutes the main important point of the liquid crystal display 12 is shown are an important section enlarged drawing of the liquid crystal display panel 13.

[0032] As shown in drawing 1 - drawing 3, the liquid crystal display 12 is the structure which pasted together the signal side glass substrate 14 of the rectangular shape of the large area which is a transparent substrate of said another side, and the scan side glass substrate 15 of the rectangular shape of the small area which is said one transparent substrate via the liquid crystal.

[0033] the portion top which does not counter with the scan side glass substrate 15 in near the one-side end which is non display regions of the signal side glass substrate 14 -- FPC16 of rectangular form -- the one-side end of the principal surface on the other hand, [ stick and ] It bends that it is also near [ that ] pasting about this FPC16, and other \*\*\*\* of FPC16 are pulled out on the outside of the scan side glass substrate 15, thereby, adhesives (not shown), such as a double-sided tape, are used for the outside of the scan side glass substrate 15, and FPC16 is allocated.

[0034] This FPC16 pastes together the base film which comprises polyimide and polyester, the circuit pattern formed in copper foil, and the cover lay which comprises polyimide and polyester one by one with polyester system adhesives.

[0035] And on FPC16, circuit components (not shown), such as the driver IC 5 for a liquid crystal drive and a capacitor, are mounted.

[0036] In the liquid crystal display 12 of this invention, in order to use the still higher-density pixel pattern on a high screen, carry out the display screen of the liquid crystal display panel 13 for 2 minutes, but. As shown in drawing 4 in connection with this, the transparent electrode by the side of the scan arranged on the scan side glass

substrate 15 is divided into the transparent electrode pattern 17 and the transparent electrode pattern 18.

[0037]The composition of the liquid crystal display panel 13 is as follows further about these transparent electrode patterns 17 and 18.

[0038]As shown in drawing 5, the light reflection layer 19 formed on the medial surface of the scan side glass substrate 15 with the metal thin film which comprises aluminum is formed. The light filter 20 arranged for every pixel on this light reflection layer 19, the overcoat layer 21 which comprises acrylic resin, the transparent electrode 22 which comprises ITO, and the orienting film 23 which changes from the polyimide resin which carried out rubbing to a certain direction are laminated one by one.

[0039]On the signal side glass substrate 14, the transparent electrode 24 which comprises ITO, the insulating layer 25 which comprises  $\text{SiO}_2$ , and the orienting film 26 which changes from the polyimide resin which carried out rubbing to a certain direction are laminated one by one. And although the signal side glass substrate 14 and the scan side glass substrate 15 are pasted together via the liquid crystal 27 as a sealant is also, and the liquid crystal 27 is enclosed. In that case, both transparent electrodes 22 and 24 are made to intersect perpendicularly, and it accomplishes with each pixel that it is also at the crossing portion, and constitutes in the reflective color LCD panel 12 of a passive matrix.

[0040]The phase difference plate (not shown) which comprises polycarbonate etc., and the polarizing plate (not shown) of an iodine system are stuck on the display surface side of this liquid crystal display 12 using the adhesive material which comprises an acrylic material one by one.

[0041]According to the liquid crystal display 12 of the above-mentioned composition, the transparent electrode 22 formed in the scan side glass substrate 15 is equivalent to the aforementioned transparent electrode patterns 17 and 18. The transparent electrode 22 (transparent electrode patterns 17 and 18). By allotting conductive members, such as Ag material, between the substrate 14 and the substrate 15, or using the sealant containing electric conduction particles. Make the wiring which comprises ITO formed on the signal side glass substrate 14 energize, this wiring is made to extend even in the non display regions on the signal side glass substrate 14, a chromium layer and an aluminum layer are laminated one by one at that end, and the terminals 28 and 29 are formed.

[0042]It corresponded to the transparent electrode pattern 17, the terminal 29 corresponded to the transparent electrode pattern 18, and the terminal 28 arranges

both terminals 28 and 29 to the part which does not face each other on the both sides of the opposing side of a display screen, respectively.

[0043]By what the terminals 30 and 31 which comprise an Au layer were formed also on FPC16, between the terminal 28 and the terminals 30 was connected by the wire bonding 32, and between the terminal 29 and the terminals 31 was connected for by the wire bonding 33. A signal input can be carried out to the display portion of the liquid crystal display panel 13 through the wire bonding 32 and 33 from the driver IC 5 for a liquid crystal drive.

[0044]The transparent electrode 24 on the signal side glass substrate 14 lets a sealant pass, and extends even to the part with tension of FPC16, and energization connection is made with the terminal of this FPC16.

[0045]According to the liquid crystal display 12 of this invention, the terminals 30 and 31 on FPC16, and the terminals 28 and 29 on the non display regions of the signal side glass substrate 14 in this way because it took [ the wire bonding 32 and ] 33. The width of the non display regions became small, and became unnecessary [ the circuit pattern which was being taken about in non display regions like the conventional liquid crystal displays 1, 8, and 10 shown in drawing 6 - drawing 8 ].

[0046]For example, when the liquid crystal display 1 of COF mounting shown in the liquid crystal display 12 and drawing 6 of this invention is contrasted, it comes to be shown in drawing 9. Both sides are the liquid crystal panels of a 1.5-inch class.

[0047]The figure (b) is a sectional view according to cutting plane line A-A' at drawing 1 as well as drawing 2, and drawing 9 (\*\*) is a sectional view of the liquid crystal display 1 in the same standard.

[0048]As shown in drawing 9 (b), width A of the non display regions in the liquid crystal display 12 of this invention was able to be made small to about 1 mm, but the width B of the non display regions in the liquid crystal display 1 of drawing 9 (\*\*) to this was necessity about 5 mm.

[0049]Thus, in the conventional liquid crystal displays 1, 8, and 10, had to expand non display regions, and had to enlarge the width as the number of scan lines followed on carrying out an increase and the liquid crystal display panel big-screen-ized, but. Although based also on the size of the liquid crystal display panel 13 in the liquid crystal display 12 of this invention to this, As for the width A of non display regions, 3 mm or less and enlargement of the liquid crystal display panel 13 can make it suitably small to 1 mm or less the optimal 2 mm or less, and according to expansion of overcrowded-izing of a circuit pattern and non display regions by this were canceled.

[0050]In this invention, the wiring resistance difference resulting from the wire length

of a circuit pattern like before was canceled, the density unevenness by the provincial accent of the voltage waveform impressed to an electrode in a display portion in connection with this stops having occurred, and display quality has been improved by this.

[0051]Moreover, by the thing of the display portion of the liquid crystal display panel 13 for which FPC16 is mostly allotted in the center, it became the same among both sides about the interval in which it results to each terminals 30 and 31 formed on this, and this was also able to raise display quality.

[0052]Next, it is explained that a personal digital assistant is also about the display of this invention. The cellular phone 34 which carries the liquid crystal display 12 in drawing 10 is explained. According to the cellular phone 34, the liquid crystal display 12 is allocated in the small case 35. The antenna 36 for transmission/reception is formed in the upper part of the case 35, and the receiver 37 and the microphone 38 are further formed in the surface.

[0053]The personal digital assistant 39 which allocated the liquid crystal display 12 in drawing 11 is explained. This personal digital assistant 39 is shown as various information terminals other than cellular-phone 34. For example, although there are a clock, a computer, a game machine machine, pedmeter, GPS, POS, a handy terminal, an industrial instrument, etc., it is not limited to these. Also in this personal digital assistant 39, the liquid crystal display 12 is allocated in the small case 40.

[0054]In this way, in these cellular phones 34 or the personal digital assistant 39, it is having used the miniaturized liquid crystal display liquid crystal display 12, and the miniaturization was able to be attained further.

[0055]Although it illustrated that the cellular phone 34 and the personal digital assistant 39 were also as a device which allocated the liquid crystal display 12 of this invention, this liquid crystal display 12 is applicable also to the various equipment used as a display device. For example, it may be used also for the plotting board of various display equipment, such as a display panel in a sewing machine, a stereo, a musical instrument, video, ATM, a copying machine and a facsimile, a station, a restaurant, and a factory.

[0056]This invention is not limited to the above-mentioned example of an embodiment, and various change, improvement, etc. in the range which do not deviate from the gist of this invention do not interfere at all.

[0057]For example, although formed as the light reflection layer 19 in the above-mentioned example with the metal thin film which comprises aluminum, in order to replace with this and to raise reflectance, the multilayer film which comprises a

dielectric may be used.

[0058] Although this example explained that the high-reflective-liquid-crystal display for passive-matrix type (STN) colored presentations was also, Replace with this and A TN liquid crystal method, a TFT-liquid-crystal method, a ferroelectric liquid crystal method, the various high-reflective-liquid-crystal displays using an antiferroelectricity liquid crystal method, a bistability type liquid crystal method, etc. being sufficient, and the light reflection layer 19 being further, formed as the semi transmitting layer which sets and has the both sides of light reflex nature and a light transmittance state is also, and, Even if it uses a transfective liquid crystal display by having a back light, the effect of this invention is similarly done so.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is a perspective view of the high-reflective-liquid-crystal display of this invention.

[Drawing 2] cutting plane line A-A in drawing 1 — ' — it is a sectional view to twist.

[Drawing 3] cutting plane line B-B in drawing 1 — ' — it is a sectional view to twist.

[Drawing 4] It is a top view showing the composition of the transparent electrode by the side of the scan of the liquid crystal display panel concerning this invention.

[Drawing 5] It is an important section expanded sectional view of the liquid crystal display panel concerning this invention.

[Drawing 6] It is a top view of the liquid crystal display of the conventional COF mounting.

[Drawing 7] It is a top view of the liquid crystal display of the conventional TAB mounting.

[Drawing 8] It is a top view of the liquid crystal display of the conventional COG package.

[Drawing 9] (b) cutting plane line A-A in drawing 1 concerning the liquid crystal display of this invention -- ' -- it is a sectional view to twist and drawing 9 (\*\*) is a sectional view of the liquid crystal display of the conventional COF mounting in the same standard.

[Drawing 10] It is a front view of the cellular phone concerning this invention.

[Drawing 11] It is a front view of the personal digital assistant concerning this

invention.

[Description of Notations]

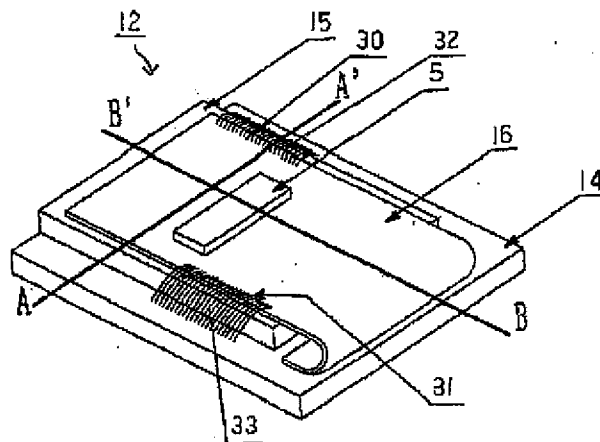
- 1, 8, 10, 12 — Liquid crystal display
- 2, 13 — Liquid crystal display panel
- 5 — Driver IC for a liquid crystal drive
- 6, 11, 16 — FPC
- 9 — TCP
- 14 — The signal side glass substrate
- 15 — The scan side glass substrate
- 17, 18 — Transparent electrode pattern
- 19 — Light reflection layer
- 20 — Light filter
- 22, 24 transparent electrodes
- 23, 26 — Orienting film
- 27 — Liquid crystal
- 28, 29, 30, 31 — Terminal
- 32, 33 — Wire bonding

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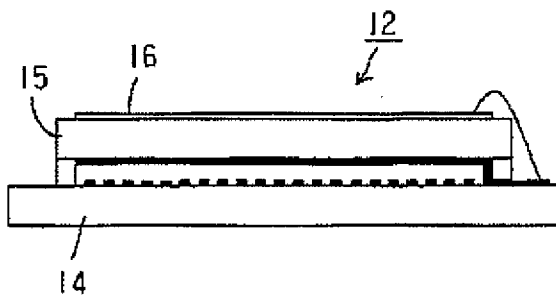
**DRAWINGS**

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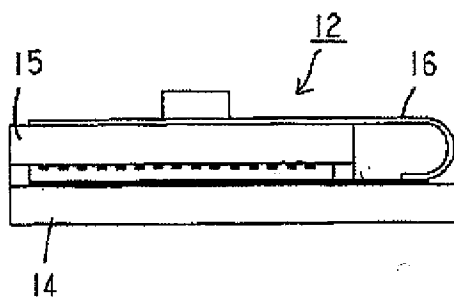
[Drawing 1]



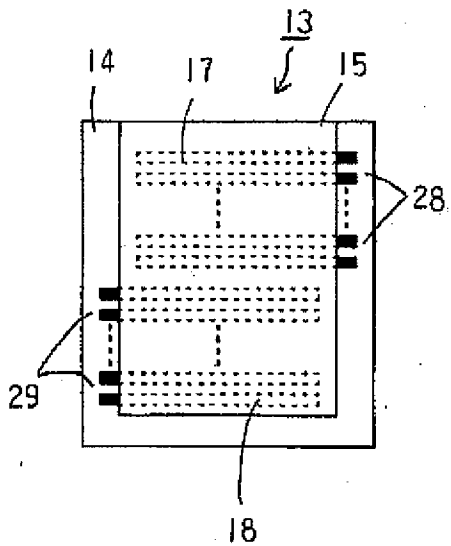
[Drawing 2]



[Drawing 3]

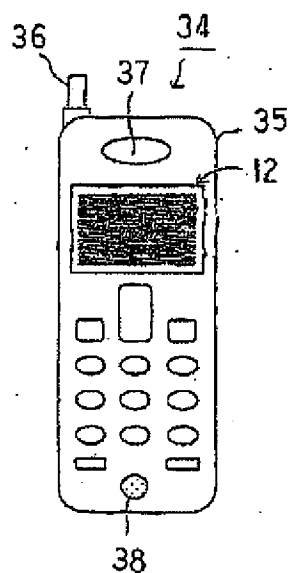


[Drawing 4]

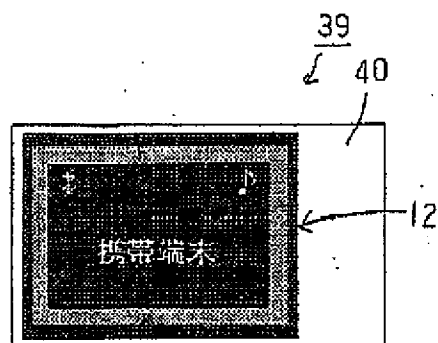


[Drawing 10]

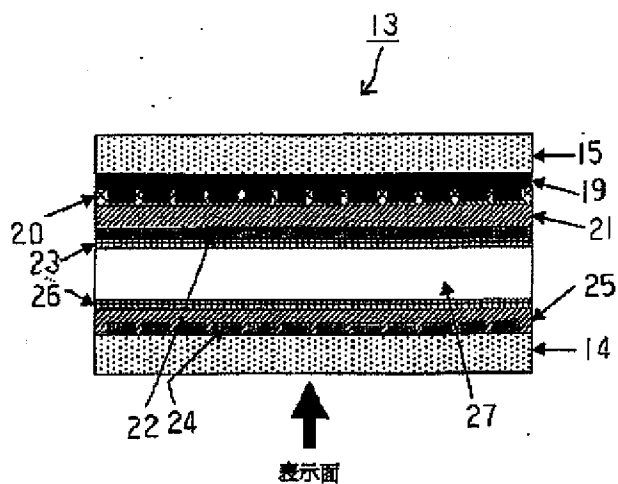




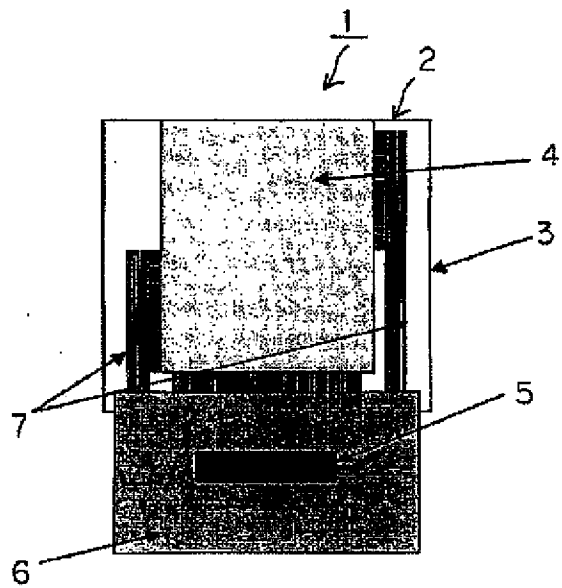
[Drawing 11]



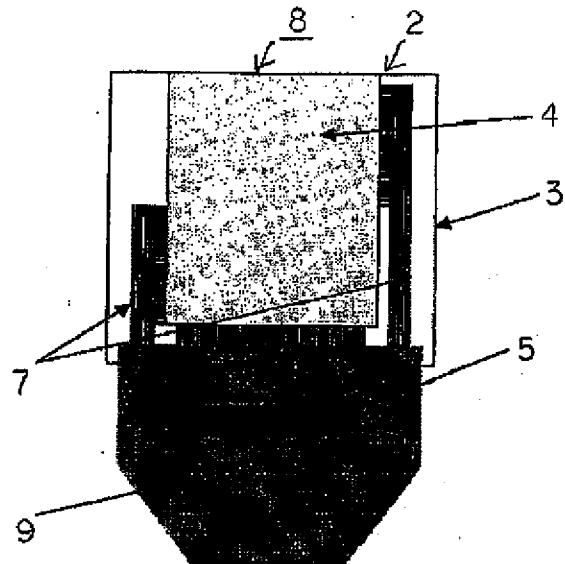
[Drawing 5]



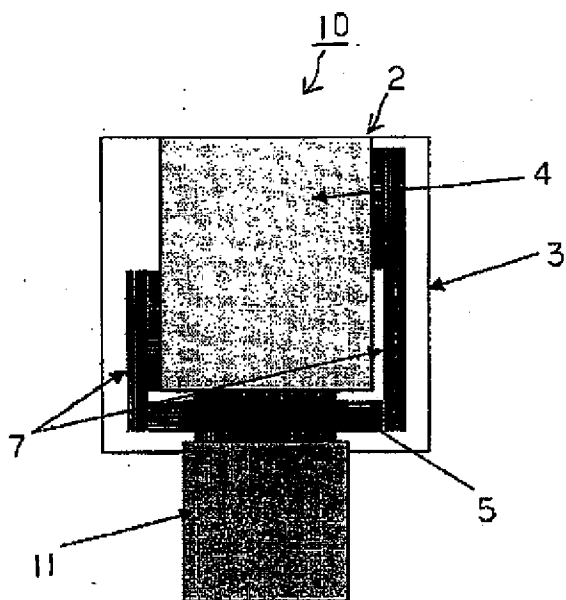
[Drawing 6]



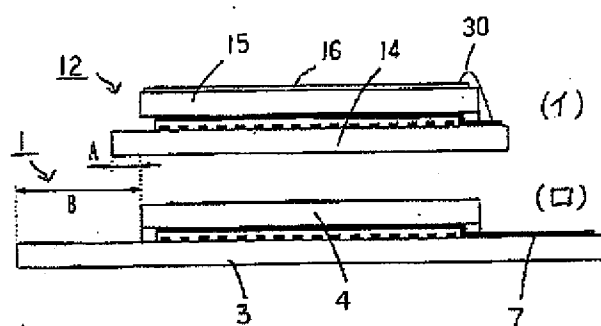
[Drawing 7]



[Drawing 8]



[Drawing 9]



## 対応なし、英抄

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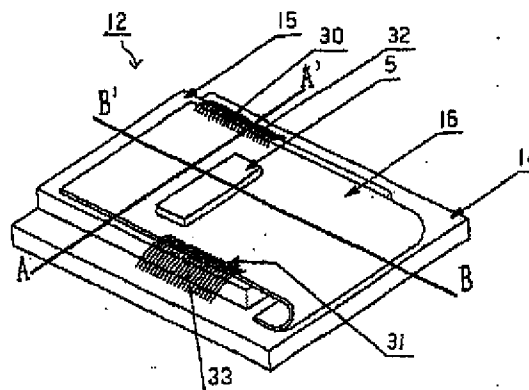
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(54) 【発明の名称】 液晶表示装置および表示機器

(57) 【要約】

【課題】高密度配線化および狭領域化を達成し、さらに濃度ムラの発生を防ぎ、高品質かつ高信頼性、低コストの液晶表示装置を提供する。

【解決手段】大面積の信号側ガラス基板14と小面積の走査側ガラス基板15とを液晶を介して貼り合わせた液晶表示装置12であり、ガラス基板14の非表示領域にFPC16の一方主面の一辺端を貼付け、その貼付け付近で折り曲げ、FPC16の他辺端を走査側ガラス基板15の外側に引出し、そして、FPC16の上には液晶駆動用ドライバIC5やコンデンサ等の回路部品(図示せず)を実装している。



## 【特許請求の範囲】

【請求項1】透明電極と配向層とを順次積層してなる2つの透明基板間に液晶を介在してなる液晶表示装置における一方の透明基板の外面もしくは内面に光反射層を形成した反射型液晶表示装置であって、フレキシブル回路基板の一端を他方の透明基板に固定し、他端を一方の透明基板の外側に引出すことで、液晶駆動用ドライバICを実装したフレキシブル回路基板を一方の透明基板の外側に配設し、さらに他方の透明基板上に形成した端子とフレキシブル回路基板上の端子との間をワイヤーボンディングにより接続して液晶駆動用ドライバICより信号入力せしめることを特徴とする液晶表示装置。

【請求項2】請求項1の液晶表示装置を搭載したことを特徴とする表示機器。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明はバックライト等の透過型補助光源を不要とする反射型の液晶表示装置ならびにこの液晶表示装置を搭載した表示機器に関するものである。

【0002】

【従来の技術】近年、携帯電話や携帯型位置測定システム（通称、GPSと呼ばれる）などの表示装置に液晶表示装置が用いられているが、この液晶表示装置に対し、小型化、低消費電力化および屋外での適用性という特性が求められている。

【0003】この要求に応じるために、屋外での良好な視認性を特徴とする反射型液晶表示装置や半透過型液晶表示装置が使用されるようになってきた。

【0004】これらの液晶表示装置は、携帯電話などの用途において、従来、モノクロ表示のパネルが用いられ、そして、1チップの液晶駆動用ドライバICが使用されてきた。

【0005】これらの液晶表示装置における実装方式として、液晶駆動用ドライバICを実装したフレキシブル回路基板（以下、フレキシブル回路基板をFPCと略記する）を用いたCOF実装、液晶駆動用ドライバICを内蔵したテープキャリアパッケージ（以下、テープキャリアパッケージをTCPと略記する）を用いたTAB実装、液晶駆動用ドライバICを透明基板上に直接実装するCOG実装が提唱されている。

【0006】これらのCOF実装、TAB実装、COG実装を用いた単純マトリクス型の反射型モノクロ液晶表示装置の概略を図6～図8により説明する。

【0007】図6はCOF実装の液晶表示装置の平面図、図7はTAB実装の液晶表示装置の平面図、図8はCOG実装の液晶表示装置の平面図である。

【0008】最初に図6の液晶表示装置1を説明すると、その主要構成部分である液晶表示パネル2は大面積の信号側ガラス基板3と小面積の走査側ガラス基板4と

を液晶を介して貼り合わせた構造であり、この信号側ガラス基板3に液晶駆動用ドライバIC5を実装したFPC6を貼り付けている。

【0009】このFPC6はポリイミドやポリエステルから成るベースフィルム、銅箔にて形成された配線パターン、ポリイミドやポリエステルから成るカバーレイをポリエステル系接着剤にて順次貼り合わせたものである。

【0010】また、FPC6には液晶駆動用ドライバIC5以外にコンデンサ等の回路部品（図示せず）も実装可能である。

【0011】7は液晶表示パネル2の表示部分とFPC6とを通電させるために、信号側ガラス基板3上の非表示領域に形成したITOから成る信号配線である。

【0012】図7のTAB実装の液晶表示装置8は、前記の液晶表示装置1に使用したFPC6に代えて、液晶駆動用ドライバIC5を実装したTCP9を用いている。

【0013】図8のCOG実装の液晶表示装置10では、液晶駆動用ドライバIC5を信号側ガラス基板3上の非表示領域に実装したものであるが、この非表示領域に対しコンデンサ等の回路部品（図示せず）を実装したFPC11を貼り付け、これにより、液晶駆動用ドライバIC5へ信号を入力している。

【0014】

【発明が解決しようとしている課題】上述した如く、携帯電話など用途の液晶表示装置は、COF実装、TAB実装、COG実装を用いたモノクロタイプである。

【0015】これに対し、近年、カラータイプの液晶表示装置が求められ、とくに携帯電話用途においては、その反射型・半透過型の液晶表示装置に対しては、モノクロ液晶表示パネルからカラー液晶表示パネルへの移行が進んでいる。

【0016】したがって、このようなカラー化に伴い携帯端末などの表示機器として取り扱う情報量が増大し、そのために、よりドット数の多い大画面の液晶表示パネルが切望されている。

【0017】しかしながら、前述したような図6～図8の各実装方式の液晶表示装置1、8、10においては、液晶駆動用ドライバIC5と表示部分とを並設した構造であり、そのために信号配線7の配線長が伸びなくなり、その違いが顕著になり、これによって配線抵抗差に起因して表示品位が低下し、たとえば各画素間に配線抵抗が異なることで、表示部分での電極に印加する電圧波形がなまり、これにより、液晶にかかる実効電圧に差が生じ、その結果、濃度ムラが発生していた。この濃度ムラはカラー液晶表示装置において、きわめて顕著な課題であった。

【0018】この課題を解消すべく、信号配線7のパターン幅を調整して、抵抗格差を改善することが考えられ

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るが、その技術にも限界がある。そのため、ITOによる信号配線に代って、Al等を用いた金属配線も検討されている。しかしながら、そのための技術を確立して、設備導入等をおこなう必要があり、また、金属配線パターンを過密化すると、製造歩留まりの低下により量産性が低下するので、非表示領域を広げる必要があるが、その反面、狭領域の液晶表示パネルが得られなくなり、携帯端末の用途には不適になる。

【0019】また、携帯電話等の携帯端末においては、ますます小型化および薄型化、ならびに軽量化も市場のニーズであるが、いまだ満足し得る程度にまで至っていないと言える。

【0020】したがって本発明の目的は、製造歩留まりおよび量産性を高めるとともに、高密度配線化および液晶表示パネルの狭領域化を達成し、さらに液晶にかかる実効電圧に差が生じないようにして濃度ムラの発生を防ぎ、これによって高品質かつ高信頼性ならびに低コストの液晶表示装置を提供することにある。

【0021】本発明の他の目的は小型化と薄型化を成した液晶表示装置を提供することにある。

【0022】本発明のさらに他の目的はカラー表示に適した液晶表示装置を提供することにある。

【0023】また、本発明の目的は、かかる本発明の液晶表示装置を搭載して、高品質かつ高信頼性、低コスト、小型化ならびに薄型化を達成した携帯端末、さらには表示機器を提供することにある。

【0024】

【課題を解決するための手段】本発明の液晶表示装置は、透明電極と配向層とを順次積層してなる2つの透明基板間に液晶を介在してなる液晶表示装置における一方の透明基板の外面もしくは内面に光反射層を形成した反射型液晶表示装置であって、フレキシブル回路基板の一端を他方の透明基板に固定し、他端を一方の透明基板の外側に引出すことで、液晶駆動用ドライバICを実装したフレキシブル回路基板を一方の透明基板の外側に配設し、さらに他方の透明基板上に形成した端子とフレキシブル回路基板上の端子との間をワイヤーボンディングにより接続して液晶駆動用ドライバICより信号入力せしめることを特徴とする。

【0025】本発明の表示機器は、本発明の液晶表示装置を搭載したことを特徴とする。

【作用】本発明の液晶表示装置は、上記構成のように液晶駆動用ドライバICを実装したフレキシブル回路基板を表示裏面側の一方の透明基板の外側に配設し、さらに他方の透明基板上に形成した端子とフレキシブル回路基板上の端子との間をワイヤーボンディングにより接続して液晶駆動用ドライバICより信号入力せしめることで、従来の液晶表示装置のように非表示領域にて引き回していた配線パターンがきわめて小さくなったり、もしくは不要となる。

【0026】したがって、従来の実装方式の液晶表示装置においては、1.5インチクラスの液晶パネルにおいて非表示領域の幅が4~5mm程度必要であったが、これに対する本発明の液晶表示装置では、その幅が1mm程度にまで小さくすることができ、これにより、配線パターンの過密化、非表示領域の拡大による液晶表示パネルの大型化が解消される。

【0027】しかも、上記構成のように、他方の透明基板上に形成した端子とフレキシブル回路基板上の端子との間をワイヤーボンディングにより接続し、これによって液晶駆動用ドライバICより信号入力するように成したことで、すなわち表示部分上に液晶駆動用ドライバICを重ねた構造にしたことで、配線パターンの配線長に起因する配線抵抗差がなくなり、表示部分で電極に印加される電圧波形のなまりが解消されることにより濃度ムラが発生しなくなり、その結果、表示品位が改善され、とくに液晶駆動用ドライバICを1チップ配設したカラー液晶表示装置において顕著に改善される。

【0028】なお、本願出願人は、すでに液晶表示パネルの裏面に、液晶駆動用ドライバICと長尺状の回路基板とを配設した液晶表示装置を提案したが、いまだ下記のような課題があると言える。

【0029】その回路基板ではガラスエポキシ基板の内部に1層配線や2層以上の配線層を形成した多層配線構造であり、そのためにきわめて基板厚が大きくなり、近年の薄型化という市場ニーズにはいまだ満足し得ていない。また、基板厚の回路基板の端子と透明基板上の端子との間をワイヤーボンディングにより接続しているが、そのワイヤ長が大きくなることで、ボンディングの精度面では不十分である。しかも、非表示領域に長尺状の回路基板を配置することで、液晶駆動用ドライバICの実装部位も限定される。

【0030】

【発明の実施の形態】本発明の反射型液晶表示装置の概略を単純マトリクス型(STN)のカラー表示を例にして図1~図5により説明する。

【0031】図1は反射型の液晶表示装置12の斜視図であり、図2は図1にて切断面線A-A'による断面図、図3は図1にて切断面線B-B'による断面図である。また、図4は液晶表示装置12の主要を成す液晶表示パネル13の走査側の透明電極の構成を示す平面図、図5は液晶表示パネル13の要部拡大図である。

【0032】図1~図3に示すように、液晶表示装置12は前記他方の透明基板である大面積の矩形形状の信号側ガラス基板14と、前記一方の透明基板である小面積の矩形形状の走査側ガラス基板15とを液晶を介して貼り合わせた構造である。

【0033】信号側ガラス基板14の非表示領域である一辺端付近において、走査側ガラス基板15と対向しない部分の上に、長方形形状のFPC16の一方主面の一辺

端を貼付け、そして、このFPC16を、その貼付付近でもって折り曲げ、FPC16の他辺端を走査側ガラス基板15の外側に引出し、これにより、FPC16を走査側ガラス基板15の外側に両面テープ等の接着剤(図示せず)を用いて配設する。

【0034】このFPC16はポリイミドやポリエステルから成るベースフィルム、銅箔にて形成された配線パターン、ポリイミドやポリエステルから成るカバーレイをポリエステル系接着剤にて順次貼り合わせたものである。

【0035】そして、FPC16の上には液晶駆動用ドライバIC5やコンデンサ等の回路部品(図示せず)を実装している。

【0036】本発明の液晶表示装置12においては、高画面にて、さらに高密度の画素パターンにするために、液晶表示パネル13の表示画面を2分するが、これに伴って図4に示す如く、走査側ガラス基板15上に配列した走査側の透明電極を透明電極パターン17と、透明電極パターン18とに分けている。

【0037】この透明電極パターン17、18に関し、さらに液晶表示パネル13の構成は以下のとおりである。

【0038】図5に示すように、走査側ガラス基板15の内側面上にA1から成る金属薄膜により形成された光反射層19を形成し、この光反射層19上に各画素ごとに配置したカラーフィルタ20、アクリル系樹脂から成るオーバーコート層21、ITOから成る透明電極22、一定方向にラビングしたポリイミド樹脂から成る配向膜23とを順次積層している。

【0039】また、信号側ガラス基板14上にはITOから成る透明電極24、SiO<sub>2</sub>から成る絶縁層25、一定方向にラビングしたポリイミド樹脂から成る配向膜26とを順次積層している。そして、信号側ガラス基板14と走査側ガラス基板15とを液晶27を介してシール材でもって貼り合わせ、その液晶27を封入するが、その際、双方の透明電極22、24を直交させて、その交差部分でもって各画素と成し、単純マトリクス型のカラー液晶表示装置12に構成する。

【0040】この液晶表示装置12の表示面側には、ポリカーボネイトなどから成る位相差板(図示せず)とヨウ素系の偏光板(図示せず)とを順次アクリル系の材料から成る粘着材を用いて貼り付ける。

【0041】上記構成の液晶表示装置12によれば、走査側ガラス基板15に形成した透明電極22は前記の透明電極パターン17、18に対応し、透明電極22(透明電極パターン17、18)は、Ag材などの導電部材を基板14と基板15との間に配したり、もしくは導電粒子を含むシール材を使用することで、信号側ガラス基板14上に形成したITOから成る配線に通電させ、この配線を信号側ガラス基板14上の非表示領域にまで延

在させ、その端部にクロム層とアルミニウム層とを順次積層して端子28、29を形成する。

【0042】端子28は透明電極パターン17に対応し、端子29は透明電極パターン18に対応し、両方の端子28、29は、それぞれ表示画面の対向辺の双方にて向き合わない部位に配置している。

【0043】また、FPC16の上にもAu層から成る端子30、31を形成し、端子28と端子30との間をワイヤーボンディング32により接続し、端子29と端子31との間をワイヤーボンディング33により接続したことで、液晶駆動用ドライバIC5よりワイヤーボンディング32、33を通して液晶表示パネル13の表示部分に信号入力することができる。

【0044】また、信号側ガラス基板14上の透明電極24はシール材を通して、FPC16の張付部位にまで延在し、このFPC16の端子と通電接続されている。

【0045】かくして本発明の液晶表示装置12によれば、FPC16上の端子30、31と、信号側ガラス基板14の非表示領域上の端子28、29とをワイヤーボンディング32、33したことで、その非表示領域の幅が小さくなり、図6～図8に示す従来の液晶表示装置1、8、10のように非表示領域にて引き回していた配線パターンが不要となった。

【0046】たとえば本発明の液晶表示装置12と図6に示すCOF実装の液晶表示装置1とを対比すると図9に示すようになる。双方とも1.5インチクラスの液晶パネルである。

【0047】同図(イ)は図2と同じく図1にて切断面線A-A'による断面図であり、図9(ロ)は同じ基準での液晶表示装置1の断面図である。

【0048】図9(イ)に示すように本発明の液晶表示装置12における非表示領域の幅Aは約1mm程度にまで小さくすることができたが、これに対する図9(ロ)の液晶表示装置1における非表示領域の幅Bは約5mm程度必要であった。

【0049】このように従来の液晶表示装置1、8、10では、走査ライン数が増大化するに伴って、液晶表示パネルが大画面化するに従って、非表示領域を拡大し、その幅を大きくしなければならなかったが、これに対する本発明の液晶表示装置12では、液晶表示パネル13のサイズにもよるが、非表示領域の幅Aは3mm以下、好適には2mm以下、最適には1mm以下にまで小さくすることができ、これにより、配線パターンの過密化、非表示領域の拡大による液晶表示パネル13の大型化が解消された。

【0050】また、本発明においては、従来のような配線パターンの配線長に起因する配線抵抗差が解消され、これに伴い表示部分で電極に印加される電圧波形のなまりによる濃度ムラが発生しなくなり、これによって表示品位が改善された。

【0051】その上、液晶表示パネル13の表示部分のほぼ中央にFPC16を配することで、この上に形成した各端子30、31へ至る間隔を、双方の間にて同じになり、これによっても表示品位を高めることができた。

【0052】次に本発明の表示装置を携帯端末でもって説明する。図10にて液晶表示装置12を搭載した携帯電話34を説明する。携帯電話34によれば、小型の筐体35内に液晶表示装置12を配設している。また、筐体35の上部には送信/受信用のアンテナ36を設け、さらに表面にはレシーバ37とマイク38とが形成されてい

る。【0053】図11にて液晶表示装置12を配設した携帯端末39を説明する。この携帯端末39は携帯電話34以外のさまざまな情報端末として示す。たとえば、時計、計算機、ゲーム機器、万歩計、GPS、POS、ハンディターミナル、工業計器などがあるが、これらに限定されるものではない。この携帯端末39においても、小型の筐体40内に液晶表示装置12を配設している。

【0054】かくしてこれら携帯電話34や携帯端末39においては、小型化した液晶表示装置液晶表示装置12を用いたことで、さらに小型化を達成することができた。

【0055】また、本発明の液晶表示装置12を配設した装置として、携帯電話34や携帯端末39でもって例示したが、その他、この液晶表示装置12を表示デバイスとして使用する各種機器にも適用できる。たとえば、ミシン、ステレオ、楽器、ビデオ、ATM、複写機やファクシミリ、駅、レストラン、工場内の表示パネルなどのさまざまな表示機器の表示板にも使用してもよい。

【0056】なお、本発明は上記の実施形態例に限定されるものではなく、本発明の要旨を逸脱しない範囲での種々の変更や改良等は何等差し支えない。

【0057】たとえば、前述の例では光反射層19として、Alから成る金属薄膜により形成したが、これに代えて反射率を高めるために誘電体から成る多層膜を用いてもよい。

【0058】また、本例では、単純マトリクス型(STN)のカラー表示用の反射型液晶表示装置でもって説明したが、これに代えて、TN液晶方式、TFT液晶方式、強誘電性液晶方式、反強誘電性液晶方式および双安定性液晶方式等を用いた各種反射型液晶表示装置でもよく、さらには光反射層19を光反射性と光透過性の双方をあわせもつ半透過層でもって形成し、そして、バックライトを備えることで半透過型の液晶表示装置にしても同様に本発明の効果を奏する。

【0059】

【発明の効果】以上のとおり、本発明の液晶表示装置によれば、液晶駆動用ドライバICを実装したフレキシブル回路基板を表示裏面側の一方の透明基板の外側に配設

し、さらに他方の透明基板上に形成した端子とフレキシブル回路基板の端子との間をワイヤーボンディングにより接続して液晶駆動用ドライバICより信号入力したことで、従来の液晶表示装置のように非表示領域にて引き回していた金属配線パターンがきわめて小さくなったり、もしくは不要となり、その結果、金属配線パターンの過密化、非表示領域の拡大による液晶表示パネルの大型化が解消され、しかも、表示部分での電極に印加する電圧波形のなまりによる濃度ムラが発生しなくなり、表示品位が改善された。

【0060】また、本発明によれば、従来に比べ、容易に高密度配線化および液晶表示パネルの狭額縁化が達成できたことから、製造歩留まりおよび量産性を高めることができ、これによって製造コストが低減し、その結果、低コストな液晶表示装置が提供できた。

【0061】しかも、本発明においては、FPCを用いたことで、小型化と薄型化の双方を成した液晶表示装置が提供できた。そして、本発明の液晶表示装置はカラー表示に好適である。

【0062】さらにまた、本発明の表示装置においては、かかる本発明の液晶表示装置を搭載したことで、高品質かつ高信頼性、低コスト、小型化ならびに薄型化を達成した携帯端末、さらには表示機器と成り得た。

【図面の簡単な説明】

【図1】本発明の反射型液晶表示装置の斜視図である。

【図2】図1における切断面線A-A'による断面図である。

【図3】図1における切断面線B-B'による断面図である。

【図4】本発明に係る液晶表示パネルの走査側の透明電極の構成を示す平面図である。

【図5】本発明に係る液晶表示パネルの要部拡大断面図である。

【図6】従来のCOF実装の液晶表示装置の平面図である。

【図7】従来のTAB実装の液晶表示装置の平面図である。

【図8】従来のCOG実装の液晶表示装置の平面図である。

【図9】(イ)は本発明の液晶表示装置に係る図1における切断面線A-A'による断面図であり、図9(ロ)は同じ基準での従来のCOF実装の液晶表示装置の断面図である。

【図10】本発明に係る携帯電話の正面図である。

【図11】本発明に係る携帯端末の正面図である。

【符号の説明】

- 1、8、10、12…液晶表示装置
- 2、13…液晶表示パネル
- 5…液晶駆動用ドライバIC
- 6、11、16…FPC



9...TCP

14...信号側ガラス基板

15...走査側ガラス基板

17、18...透明電極パターン

19...光反射層

20...カラーフィルタ

\* 22、24透明電極

23、26...配向膜

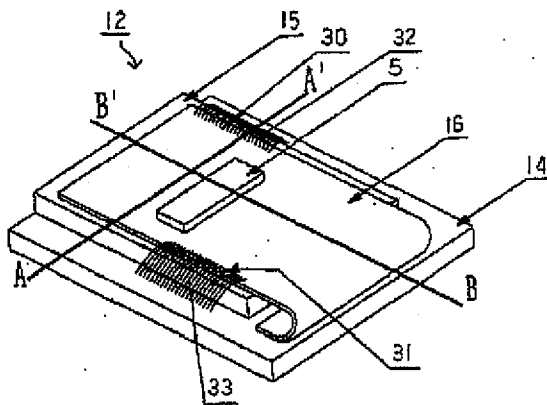
27...液晶

28、29、30、31...端子

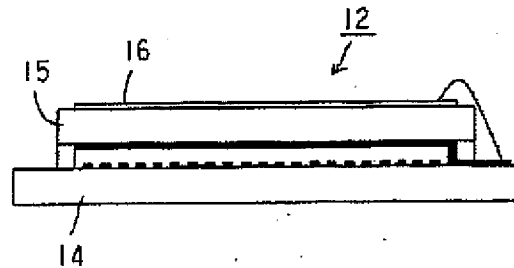
32、33...ワイヤーボンディング

\*

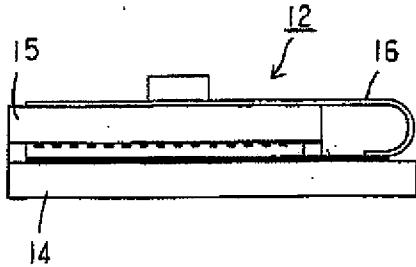
【図1】



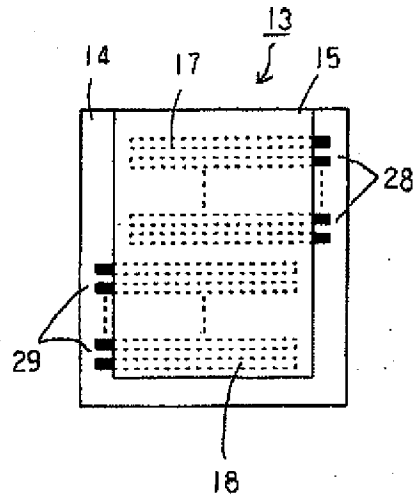
【図2】



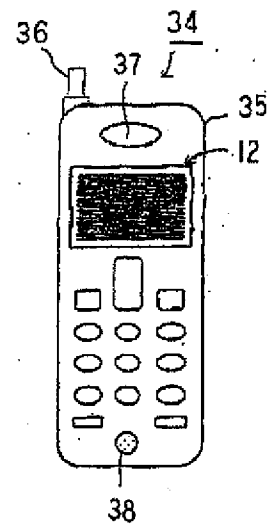
【図3】



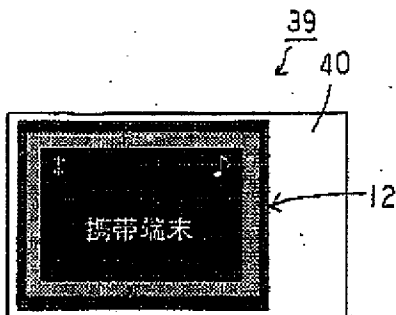
【図4】



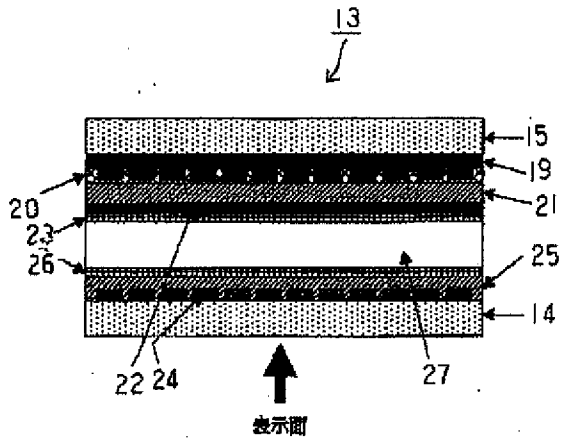
【図10】



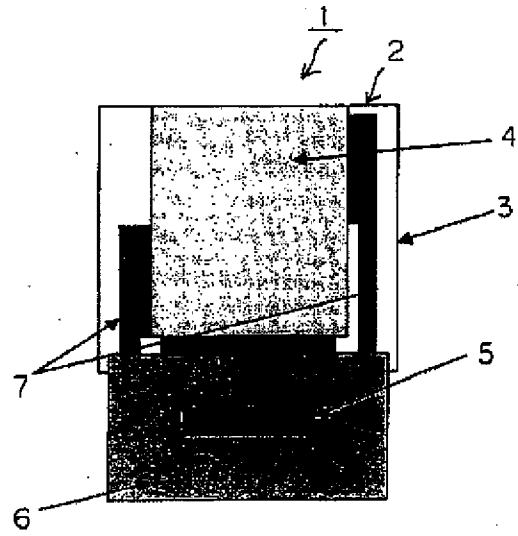
【図11】



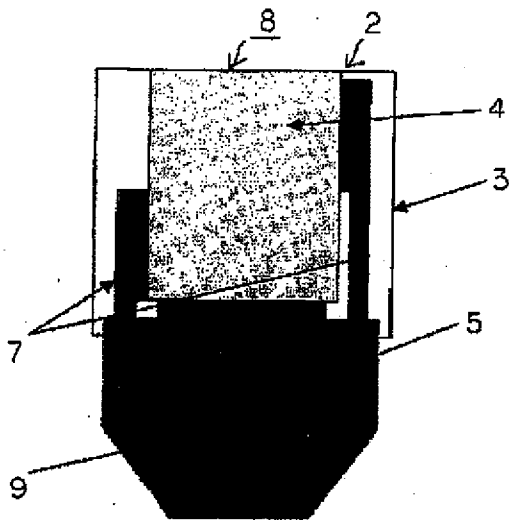
【図5】



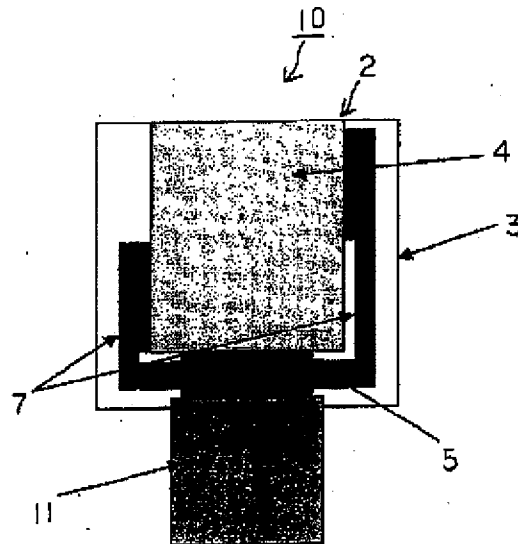
【図6】



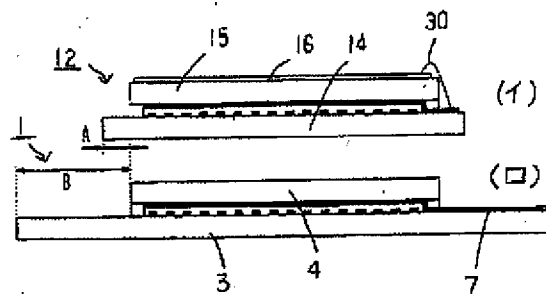
【図7】



【図8】



【図9】



フロントページの続き

Fターム(参考) 2H091 FA14Y FA14Z GA03 GA06  
 GA11 LA11 LA12  
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 LL13